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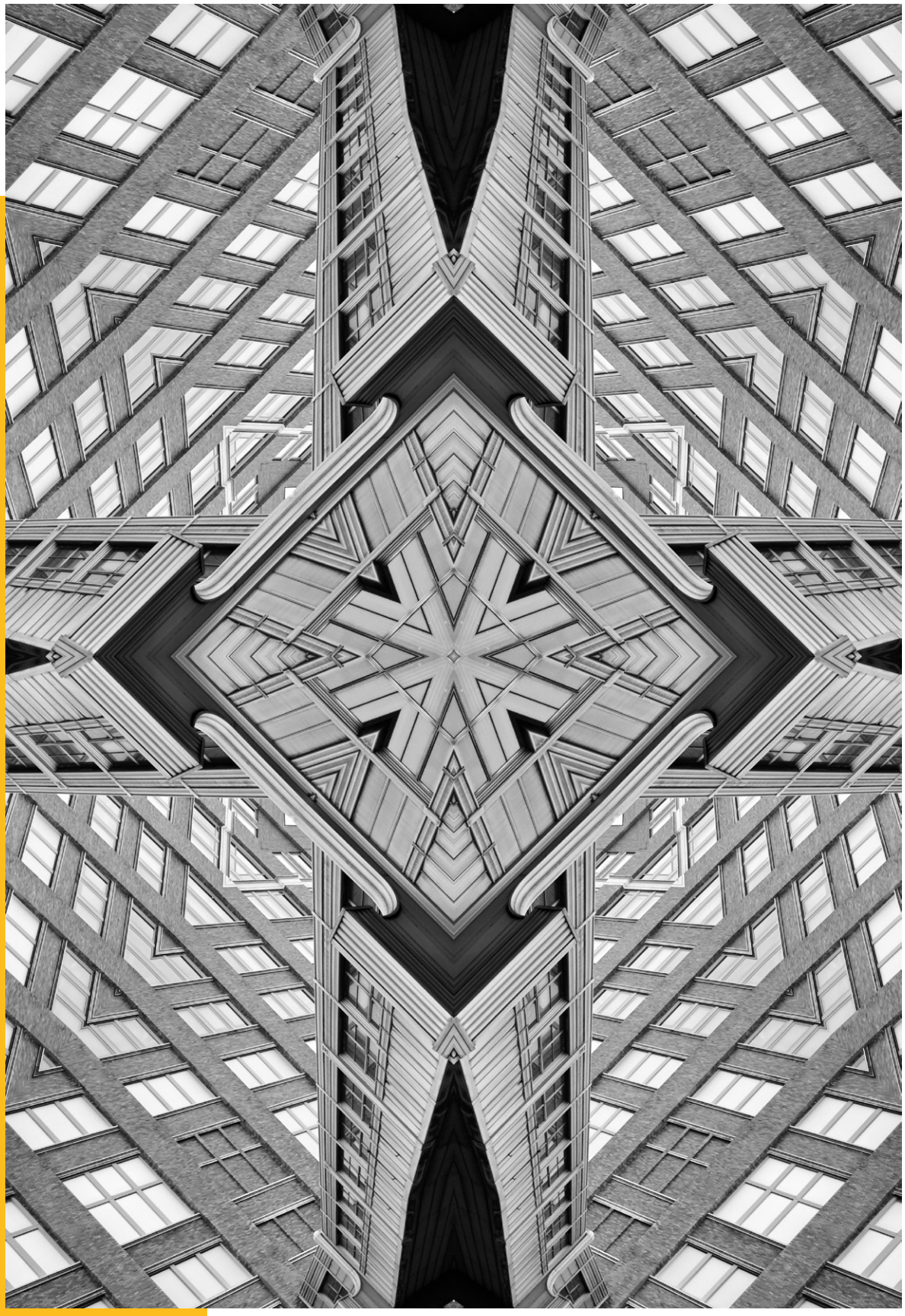

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The U.S. Escalates Chips War With China

Rajeswari Pillai Rajagopalan

Abstract

Global geopolitics is in a state of intense flux. China's rise has led to greater competition in the international system, with the United States and the post-War global order coming under increasing challenge. China's high economic growth rate in the past several decades has meant bigger military budgets. In turn, its military rise threatens security in the Indo-Pacific region where China seeks to dominate, from the Himalayas to South China Sea and East China Sea. This paper argues that China's massive military power, accompanied by its threat or use of force and aggressive actions against its neighbours has heightened insecurity across the Indo-Pacific. Yet, the China challenge is multifaceted and not just in the domain of the military. This paper focuses on the area of technology.

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Introduction

The US-China technology and trade war is reaching new heights, as the United States imposed a new round of technology controls on China in October 2022. These controls will affect "the flow of high-end semiconductors and semiconductor-manufacturing equipment to Beijing."[1] The wave of US sanctions began in 2019 as a nascent effort by the Trump Administration to limit the Chinese telecommunications giant Huawei's growing footprint in multiple regions across the globe. With the competition picking up momentum across various technologies, including military and security utilities, efforts to restrict China's access to technologies including semiconductors (or chips) and other components will likely become widespread. The US has in recent months also said that it will take "extraterritorial measures" if its allies and partners do not follow its lead in the imposition of the new measures.[2]

The European Commission, in an effort to strengthen the continent's competitiveness in the area of semiconductors, introduced the Chips Act in 2022 that primarily seeks to double Europe's market share from the current 10 percent to at least 20 percent by 2030.[3] The Act includes a number of different steps to secure Europe from semiconductor supply vulnerabilities: beefing up investments in next-generation technologies; giving access across Europe for designing tools and pilot lines for the prototyping, testing and experimentation of cutting-edge chips; ensuring a more investor-friendly structure that would aid in establishing manufacturing facilities in Europe; and instituting certification procedures for energy-efficient and trusted chips to guarantee quality and security for critical applications.

The law also seeks to assure start-ups and SMEs better access to equity finance; further skills, talent and innovation in microelectronics; build capabilities to predict and respond to possible semiconductor shortages and crises to remove supply vulnerabilities; and develop semiconductor partnerships with like-minded countries across the globe.[4] According to media reports, the Chips Act will allow for a spending of 15 billion euros (approx. US$17.11 billion) in both public and private investments until 2030.[5]

This paper describes the intensifying US-China tech war; examines the logic of this tech war; and explains the new US export control measures that have been instituted in recent months with the goal of restricting the technology flow to China. It also looks into China's domestic efforts in recent years to mitigate the repercussions of US restrictions.

Competition in the semiconductor industry has accelerated in recent years. Semiconductors, or chips, are key to a number of critical technologies such as 5G, AI, autonomous electric vehicles, and the internet of things (IoT). Many of these technologies are of important strategic value in the context of the changing nature of warfare, and countries' defence departments are among the potential beneficiaries as automation and digitalisation pick up greater traction in military affairs. Pat Gelsinger, CEO of Intel Corporation, in his Senate testimony in March 2022 remarked that the increasing requirement of semiconductors pushed by growing digitalisation has become particularly acute in the last few years.[6] Consequently, the huge growth in demand has led to critical shortages in semiconductors globally. According to the 2022 annual report of the US-based Semiconductor Industry Association, the heavy demand for digital connectivity necessitated by the pandemic along with "significant fluctuations in chip demand for other products such as cars, triggered a supply-demand imbalance felt across the world."[7]

Countries that have semiconductor production capacities are indeed better placed to dominate the global market.[8] The US and a few of its partner countries have so far succeeded in this regard, although there are several others that are beginning to invest in the domain. China, clearly recognising the critical role of semiconductors across multiple sectors including the military, has made one of the biggest investments to the tune of 1 trillion yuan (US$1.45 billion).[9] However, it has yet to reap the benefits of such heavy investments and is beginning to rethink this policy approach. Without access to components produced in the West, China cannot manufacture high-end chips that use highly advanced semiconductor nodes.[10] Commenting on China's predicament, Andrew Buss, IDC Research Director for European Enterprise Infrastructure, said that "we will see China looking more internally, with manufacturers such as SMIC serving the domestic market instead of being a foundry for Western companies."[11]

Sharing this viewpoint, Richard Gordon, practice vice president for semiconductors and electronics at Gartner, said that while China may focus on "using its semiconductor industry to service its own internal consumption more in future" it is unlikely that "they [China] will stop throwing money at the problem, but the bigger issue is that it requires expertise and time, and it will take a very long time."[12] With the US-China competition picking up, Taiwan finds itself at centrestage with the Taiwan Semiconductor Manufacturing Company (TSMC), which produces the chips that companies like Apple, Qualcomm, Broadcom, Arm and Nvidia design.[13] TSMC produces 84 percent of the most advanced chips globally.[14]

New U.S. Regulations

The US enforces a number of federal regulations aimed at restricting technology flows. These include the State Department's International Traffic in Arms Regulations (ITAR), which enforces the Arms Export Control Act (AECA), and the Department of Commerce's Export Administration Regulations (EAR) implemented by the US Department of Commerce's Bureau of Industry and Security (BIS). The BIS' regulated items are contained in the Commerce Control List (CCL).[15] In October 2022, the BIS initiated critical policy changes that involve "additional export controls on certain advanced computing semiconductor chips (chips, advanced computing chips, integrated circuits, or ICs), transactions for supercomputer end-uses, and transactions involving certain entities on the Entity List."[16] BIS "has also adopted additional controls on certain semiconductor manufacturing items and on transactions for certain IC end use."

With this policy shift, the BIS has also amended the Export Administration Regulations (EAR), which includes an addition of 31 persons to the Unverified List (UVL) as well as removing nine persons from the UVL after the BIS was able to verify their bona fides.[17] The Unverified List includes parties to whom technologies, hardware or software cannot be transacted because the BIS could not "verify their bona fides." If, "for reasons outside the US Government's control", the BIS has been unable to complete "satisfactorily" an "end-use check" with regard to a particular party, the party is then added to the UVL.[18] The new additions and deletions are all from China. BIS noted that 31 persons had to be included since it was "unable to verify their bona fides because an end-use check could not be completed satisfactorily for reasons outside the U.S. Government's control." Nine parties were removed from the UVL "because the BIS was able to verify their bona fides." These actions have the effect of "choking off China's access to the future of AI."[19]

These policy changes come in the backdrop of the Biden Administration's CHIPS and Science Act of August 2022 that the US hopes will reinforce the country's leadership in semiconductor technology, by strengthening domestic research, development, and production capacity.[20] A White House Fact Sheet noted that this Act will "strengthen American manufacturing, supply chains, and national security, and invest in research and development, science and technology, and the workforce of the future to keep the United States the leader in the industries of tomorrow, including nanotechnology, clean energy, quantum computing, and artificial intelligence." The signing of the CHIPS and Science Act immediately pushed for significant investment in the US semiconductor manufacturing with companies investing US$50 billion,

pushing the total business investment up to US$150 billion since Biden became president in January 2021.[21] The CHIPS and Science Act is a combination of two bipartisan bills, both aimed at stepping up US competitiveness in high-end technologies: the Endless Frontier Act aimed at enhancing investment in high-tech research, and the CHIPS for America Act whose goal is to revive semiconductor manufacturing in the US.[22]

Table 1
CHIPS Act Appropriations Related to Semiconductors (in US$ billions)

CHIPS Act Provisions	FY22	FY23	FY24	FY25	FY26	FY27	Total
Financial Assistance Program (Incentives)	19	5	5	5	5	0	39
National Semiconductor Technology Center	2						
National Advanced Packaging Manufacturing Program	2.5						
National Institute of Standards and Technology Semiconductor Metrology R&D	0.5						
Manufacturing USA Institute for Semiconductors	0	2	1.3	1.1	1.6	0	11
Department of Defense Semiconductor R&D Network	0	0.4	0.4	0.4	0.4	0.4	2
Department of State Technology Security and Innovation Fund	0	0.1	0.1	0.1	0.1	0.1	0.5[23]
National Science Foundation CHIPS Education Fund	0	0.025	0.025	0.5	0.5	0.5	0.2
National Telecommunications and Information Administration Wireless Supply Chain Innovation Fund						1.5	1.5

Source: Center for Security and Emerging Technology[24]

New U.S. Regulations

President Biden also signed an Inflation Reduction Act in August 2022. US Senator Sherrod Brown, a Democrat from Ohio said he supported the legislation because it provides for "subsidies for made-in-America electric vehicles and the like, meant in part to bring supply chains back from China."[25] The Act aims, among others, "to strengthen US production of critical materials and reduce our reliance on vulnerable supply chains."[26]

To be sure, not all of these rules happened quickly overnight. Rather, there has been an evolution in the manner in which the US has placed restrictions on what China and Chinese companies could access from the US in terms of critical technologies.[27]

The new US export controls announced in the first week of October 2022 seek to make it difficult for China to obtain critical technologies, prohibiting the transfer and/or sale of semiconductors made with US technology without an export license.[28] These restrictions will likely have a significant impact on Chinese research in areas like AI, high-performance computing, and supercomputers. The new rules also restrict the exports of chip-making tools and technology to China; Chinese companies require these chips to produce their own equipment. The US has also put limitations on US citizens and entities engaging with Chinese chip makers without first obtaining a specific approval, which presumably will not be easily forthcoming. It is reported that there could be around 200 passport holders, mostly Chinese and Taiwanese returnees from the US, working in Chinese semiconductor industries. According to some analysts, this may pose a bigger challenge.[29]

These new restrictions are fairly extensive and could impose severe economic and technological pain on Beijing, at least in the short term. Under Secretary of Commerce for Industry and Security Alan Estevez said in October 2022 that "we are appropriately doing everything in our power to protect our national security and prevent sensitive technologies with military applications from being acquired by the People's Republic of China's military, intelligence, and security services… The threat environment is always changing, and we are updating our policies today to make sure we're addressing the challenges posed by the PRC while we continue our outreach and coordination with allies and partners."[30] Assistant Secretary of Commerce for Export Administration Thea D. Rozman Kendler echoed the thought, saying, "The PRC has poured resources into developing supercomputing capabilities and seeks to become a world leader in artificial intelligence by 2030. It is using these capabilities to monitor, track, and surveil their own citizens, and fuel its military modernization."[31]

Hal Brands, an expert at the American Enterprise Institute, summed up the logic of the new sanctions: "to hinder Chinese economic dynamism and military muscle alike… It also reflects a sobering recognition that the US can't win its competition with China simply by running faster; it must also slow Beijing down."[32] Other experts too, argue along similar lines and say that the new export controls "demonstrate an unprecedented degree of US government intervention to not only preserve chokepoint control but also begin a new US policy of actively strangling large segments of the Chinese technology industry—strangling with an intent to kill."[33]

They argue that the Biden Administration, in effect, is trying to do four things: "(1) strangle the Chinese AI industry by choking off access to high-end AI chips; (2) block China from designing AI chips domestically by choking off China's access to US-made chip design software; (3) block China from manufacturing advanced chips by choking off access to US-built semiconductor manufacturing equipment; and (4) block China from domestically producing semiconductor manufacturing equipment by choking off access to US-built components."[34] The pains imposed on China at least in the short term are "unavoidable." As Lucy Chen, vice-president of Taipei-based Isaiah Research put it, "there are bound to be bouts of pain in replacing equipment with domestic alternatives."[35]

Prior to this wave of restrictions, the earlier US approach had limitations. The Obama Administration had restricted only the Chinese military's access to high-end chips, leaving Chinese commercial players room to continue to enjoy access to US technologies. The Obama Administration placed restrictions on the US chipmaker, Intel "from selling its high-end Xeon chips to Chinese military supercomputer research centers such as the National University of Defense Technology (NUDT)." However, "it was completely ineffective at stopping indirect sales to the shell companies that helped the Chinese military evade export controls."[36] Moreover, China's military-civilian fusion meant that on the Chinese side, there was no distinction between the civilian and military entities that dealt with these high-end critical technologies and the military was indirectly gaining access to the best technologies from the US and its partner countries.[37] Experts argue that this is precisely what the Biden Administration is trying to prevent by taking his approach, i.e., "If your policy is military-civil fusion, then the only realistic way of implementing our policy of no military end use is to end all sales to China, and we are now willing to take that step.[38]

Globally, industries from the United States, Taiwan, South Korea, Japan and the Netherlands dominate the semiconductor industry. According to the Semiconductor Industry Association (SIA), global sales of semiconductors reached US$ 574.1 billion in 2022, which the group describes as "the highest-

ever annual total and an increase of 3.3% compared to the 2021 total of $555.9 billion." This record performance in the sector happened despite the slowdown in the second half of 2022.[39] Indeed, SIA expects global demand to go up significantly in the coming years. China remained the biggest market, even as its sales worth US$ 180.4 billion in 2022 was a reduction of 6.2 percent compared to 2021.[40]

Meanwhile, the US share in the global semiconductor manufacturing capacity has declined from 37 percent in 1990 to 12 percent in 2021, as other countries have begun to make large-scale investments in the last few years.[41] In its 2021 annual report, SIA noted that this has resulted in the reality of chip manufacturing capacity now being located mostly in East Asia, with China expected to hold the largest share of global production by 2030. China's position has strengthened in recent years with considerable funding from the government in the sector, even though there are questions about the effectiveness of this approach.

China makes a number of types of chips, but for cutting-edge computer chips that go into smartphones, supercomputers or AI systems, Beijing has had to rely on a few industries in the US or US partner countries like Japan or the Netherlands.[42] This of course allows the US and its partners to "cut off the supply of chips to Chinese state or private sectors that threaten human rights or international security."[43] Towards the end of January this year, Japan and the Netherlands joined the US in restricting exports to China, making it more difficult for China to pursue some of the advanced systems that use these chips.[44] The US has been in discussions with the two countries for about two years, but the two protested against such restrictions for fear of their potential impact on their own chip-making tool companies such as ASML in the Netherlands and Tokyo Electron and Nikon in Japan.

Some of the complex SME technologies are produced by only a handful of companies in these countries. A good example is EUV photolithography equipment, a critical system for the manufacturing of logic chips, which is sold by only one firm, i.e., the Dutch company, ASML.[45] Experts say China does not have "the 'decades, if not centuries' of experience and tacit knowledge needed to replicate extreme ultraviolet (EUV) photolithography machines necessary for developing chips at or below 5nm, presenting a critical obstacle for China in progressing its chips to the most advanced nodes."[46] Similarly, electronic design automation (EDA) tools from Synopsis and Cadence of America or Siemens (Mentor Graphics) of Germany, or production equipment from America's Applied Materials and Lam Research or inspection equipment from California-based KLA are critical for China to engage in the manufacturing of semiconductors or leading-edge semiconductor devices.[47]

Given that US-China competition, particularly in tech, has been picking up for some years now, China could have anticipated such moves by the US and its partners. Nevertheless, these restrictions will still have a critical impact on China's ability to establish an indigenous base in these high-tech areas.[48] China's 'Made in China 2025' strategy, launched in 2015, had set the goal of making a significant increase in domestic semiconductor manufacturing. According to experts, China's strategy has met with some success, but "lack of access to critical intangible expertise" is an obstacle that will continue to keep China behind the US and its partners.[49] China's first investment fund created in 2014 in this regard amounted to around US$ 21 billion (139 billion renminbi) and was to be managed by the Ministry of Industry and Information Technology (MIIT). The second allocation of funds, made in October 2019, was worth US$ 35 billion (204 billion renminbi).[50] There were in addition a minimum of 15 local government funds that were set up, putting together an amount of around US$ 25 billion. Citing various reports from outside China, including those of OECD and the US Congressional Research Service (CRS), experts say that China has invested around US$ 150 billion in total, between 2014 and 2020, to efforts that aim to strengthen its semiconductor industry.[51] The Chinese government has further made an allocation of US$ 1.4 trillion for strategic industries, which include semiconductors, in its 14th Five-Year Plan (2021-2025).[52]

China would now inevitably focus on doubling down its efforts in these areas, including strengthening the policy frameworks to develop these advanced technologies. There are challenges, however, including the complex technologies involved in the semiconductor industry, and the question of cost-effectiveness.[53] While China has so far managed to enjoy the benefits of an open global market, given the intense competition between the US and China, the days when China could reap the benefits of a globalised system are likely over. Rakesh Kumar, professor at the Electrical and Computer Engineering department of the University of Illinois, observed, "Higher costs would threaten the competitiveness of chips for consumer devices, as seen by how US sanctions nearly bankrupted ZTE and hobbled Huawei. But cost won't deter the use of these pricier chips for military and other strategic purposes. The growing use of artificial intelligence—where China already has world-class strengths—in chip manufacturing and accumulated experience could also reduce the cost of alternatives, making export control measures less effective over time."[54]

Meanwhile, in mid-December, China took the US to the World Trade Organisation (WTO) on the latest round of US export controls and restrictions. China has asked for consultations in line with Article 4 of the Understanding on Rules and Procedures Governing the Settlement of Disputes ("DSU"), Article XXII of the General Agreement on Tariffs and Trade 1994 ("GATT

1994"), Article XXII of the General Agreement on Trade in Services ("GATS"), Article 8 of the Agreement on Trade-Related Investment Measures ("TRIMs Agreement"), and Article 64.1 of the Agreement on Trade-Related Aspects of Intellectual Property Rights ("TRIPS Agreement").[55] China has characterised the US measures as "discriminatory and disguised trade restrictions."[56]

China is trying to come up with more innovative solutions and strengthening its tech base to dodge the consequences of the US sanctions.[57] Chinese chipmaker, Semiconductor Manufacturing International Corporation (SMIC), for instance, said that it was producing 7-nm (nanometer) chips despite China being denied the EUV equipment.[58] It is also reported to be developing more advanced chips of 5-nm.[59] SMIC is reportedly constructing a new 300 mm wafer fab (fabrication facility).[60] Similarly, in AI and high-performance computing sectors, Chinese firms, Xiangdixian Computing Technology and Moffett AI, are considering new devices that they claim can be a replacement for the GPUs that American firms Nvidia and AMD used to sell to China. While these are clearly not as advanced, China claims they work.

Meanwhile, there are other Chinese firms, like the Advanced Micro-Fabrication Equipment Inc. (AMEC) and Shanghai Micro Electronics Equipment (Group) Co., Ltd, (SMEE), that are helping China develop an indigenous base in semiconductor technology. A Huawei-funded start-up is also reportedly entering the field and building a fab to make chips.[61] All of this suggests that China could be facing a tough indigenisation process in the immediate timeframe. In early March this year, Beijing set up a new decision-making body called the Central Commission on Science and Technology, a new institutional set up within the Communist Party of China.[62] It "will further centralise power over science and technology polices in the hands of the ruling Chinese Communist Party," a demonstration of President Xi Jinping's emphasis on self-reliance when it comes to critical technologies. Xi was quoted to have remarked to a group of National People's Congress (NPC) delegates that "amid fierce international competition ... whether we can build a socialist modernised country in an all-round way as scheduled depends on the self-reliance and self-improvement of science and technology."[63]

Following the new institutional measures, China is easing the process for the most successful chip companies to access subsidies and greater control over state-backed research.[64] According to media reports, China's domestic firms including Semiconductor Manufacturing International (SMIC), Hua Hong Semiconductor, Huawei, and equipment suppliers like Naura and Advanced Micro-Fabrication Equipment Inc China, are some of those that will gain from China's policy shift. A person with direct understanding of the policy change was quoted in the media to have said, "the Chinese government will subsidise these companies to produce and deploy localised chipmaking tools without any

funding cap, just in order to overcome US restrictions."[65] In almost an admission that the previous Chinese approach was flawed, an official is reported to have remarked that "China has wasted too much money on non-functional research to bypass the sanctions without harvest. It is time to ditch the delusions and channel all possible resources into the companies, with the capability to guide the industry out of misery."[66]

Furthermore, the restrictions imposed on China by the US and its partners are pushing businesses out of China. China is losing its place as a favourable manufacturing base, with industries exiting China and setting shop elsewhere. Kyocera, for example—a Japanese company and one of the world's largest producers of chip components—is setting up its factory back home in Japan. Globally, Kyocera has a 70-percent market share in ceramic components for chip manufacturing equipment.[67] Hideo Tanimoto, president of the company said he is pushing for "an aggressive investment strategy for Kyocera that includes construction of its first factory in Japan in nearly two decades."[68] He argued that producing the chip components in China no longer makes sense since "the business model of producing in China and exporting abroad is no longer viable." Other factors for the shift are availability of cheap labour and increase in wages, though mostly the concerns are related to the competitive dynamics between the US and China and thus the difficulty to carry on with exports from China.[69]

Amidst the global shortage in chips and the lack of reliant supply chains, other countries are claiming bigger stakes by making more investments. For example, countries of the Association of Southeast Asian Nations (ASEAN) are looking to play an important role. According to a study by a Vietnam-based consulting agency, the region has strengths, albeit limited: Malaysia, Singapore, Vietnam, the Philippines and Thailand fare well in terms of R&D and IC design, whereas Malaysia and Singapore are considered leaders within the region in wafer and equipment manufacturing. Additionally, Malaysia, the Philippines, Thailand, Vietnam and Indonesia thrive at ancillary manufacturing, and Singapore and Thailand are leaders in engineering software.[70]

Conclusion

The US appears to be on top, at least for the time being, in its tech war with China. It will strive to maintain its dominance, as demonstrated by its imposition of some of the most restrictive export control measures yet on China. The US's ability to persuade its partners—such as the Netherlands and Japan—to adopt similar measures would be a critical advantage. It will make it difficult for China to gain access to advanced semiconductor technology, including chips and tools for chip-making and know-how that it needs to manufacture its own advanced chips or semiconductor manufacturing equipment. This is another indication of the US's determination to curtail China's technology advance.

Even as China has been anticipating and preparing for this eventuality, at least in the short term, it will likely reel from the repercussions of the export control measures even as it has been taking steps to mitigate them. The high-tech competition is spreading beyond the US and China, and other countries are beginning to make investments in the same tech domains. In the near future, however, the US and its handful of partners will likely maintain their edge.[71]

Finally, it is also important to see the impact of the US-China trade and tech rivalry on India, especially since New Delhi is working to develop its own competencies. However, developing competencies in semiconductor and chips design and production are complex tasks that call for significant financial investments, R&D, cutting-edge innovation, and a large highly skilled talent pool. Col. Anurag Awasthi, Vice-President of India Electronics and Semiconductor Association (IESA), argues that skilling needs to remain the focus "as India embarks on a journey to build fabrication plants and compound semiconductors and embraces a high growth rate of the Electronics System Design & Manufacturing (ESDM) industry with a robust edifice of a policy framework."[72]

A blunt truth, however, is that India is suffering a talent deficit, although this problem is not unique to India. R&D in the area of designing chips is one aspect which is already serviced by Indian talent in large numbers worldwide. India would need to focus on other talent areas including "electricians, pipefitters and welders, technical engineers, maintenance personnel, smart factory automation specialists," as well as Indian graduates in electrical engineering who should look at manufacturing processes that are involved in the development of chips.[73] Col. Awasthi has noted, for instance, that while India has some 1.5 million engineers graduating every year, "very few opt for fields like microelectronics, electrical, chemical, and material engineering, and two main arguments can be made for the same: 'lack of awareness and availability of job options as compared to computer science and allied disciplines'."[74]

Conclusion

The Indian government has taken some purposeful decisions to address these issues, among them the establishment of the India Semiconductor Mission (ISM) as an "independent business division" within the Digital India Corporation. The ISM has been given "all the administrative and financial powers and is tasked with the responsibility of catalysing the India Semiconductor ecosystem in manufacturing, packaging and design"—this is critical in facilitating the growth spurt that is required in the sector.[75] ISM also engages the best global minds in semiconductors through an advisory body that can advise and direct India's future trajectory in the area of semiconductor and chips.

On the policy front, the Indian government has come up with four schemes to seek large investments for establishing semiconductor wafer fabrication facilities in India; for setting up Display Fabs in India; for setting up of Compound Semiconductors / Silicon Photonics / Sensors Fab / Discrete Semiconductors Fab and Semiconductor Assembly, Testing, Marking and Packaging (ATMP) / OSAT facilities in India; and a Design Linked Initiative that would offer financial incentives, design infrastructure support across the different stages of development and deployment of semiconductor design for Integrated Circuits (ICs), Chipsets, System on Chips (SoCs), Systems & IP Cores and semiconductor linked design.[76]

The establishment of semiconductor units requires large investments and critical infrastructure including uninterrupted power supply and clean water. Also crucial is the availability of large acres of land—the acquisition of which has been a particular challenge in India. These technologies, in addition to huge capital investment, involve long gestation and payback periods, which call for sustained programmes from both the centre and states. Many states including Karnataka, Telangana, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Odisha, Tripura, and Punjab, and the union territories of Dadra and Nagar Haveli and Daman & Diu have demonstrated interest in attracting companies to set up semiconductor chip manufacturing facilities in their territory.[77] The final decision on the location rests with the company based on different factors including continued power and water supply as well as state government incentives.

All of these may be impressive steps taken by the government, but it is too early to assess whether they will be effective in bringing together the talent, resources and expertise required to augment India's semiconductor mission.

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